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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/820,822	04/09/2004	Hae-Kyoung Kim	61610134US	8493

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EXAMINER	
WANG, EUGENIA	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
10/29/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATENT@PARK-LAW.COM

Office Action Summary	Application No.	Applicant(s)	
	10/820,822	KIM ET AL.	
	Examiner	Art Unit	
	Eugenia Wang	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *20* is/are allowed.

6)☒ Claim(s) *1-9,11,13,15 and 17-19* is/are rejected.

7)☒ Claim(s) *10,12,14,16 and 19* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 27, 2007 has been entered.

Response to Amendment

2. In response to the amendment received August 27, 2007:

a. Claims 1-20 are pending.

b. The previous 112 rejection is maintained.

Claim Objections

3. Claim 19 objected to because of the following informalities: reciting "ploylefin" in line 3. Examiner sees this as a typographical error that should be replaced with 'polyolefin'. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 2, 5, 8, 13, and 14 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter

which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The applicant has not provide any guidance as to how the sensor detects the fuel concentration using characteristic that volumes of the sensor change depending on the fuel concentration. What is the relationship between the sensor volume change and the fuel concentration?

In MPEP 2164 and 2164.01 states "...when claimed subject matter is only presented in the claims and not in the specification portion of the application, the specification should be objected to for lacking the requisite support for the claimed subject matter... it has been interpreted to require that the claimed invention be enabled so that any person skilled in the art can make and use the invention without undue experimentation. In re Wands, 858 F.2d at 737, 8 USPQ2d at 1404 (Fed. Cir. 1988)."

Factors to be considered in determining whether the claimed invention would require undue experimentation are given in MPEP 2164.01(a). In re Wands, 858 F. 2d 731, 737; 8 USPQ 2d 1400, 1404 (Fed. Cir. 1988). Only the relevant factors will be addressed herein for determining undue experimentation of the presently claimed invention. The relevant factors are (A) Breadth of the claims; (B) The nature of the invention; (C) The state of the prior art; and (D) The amount of direction provided by the inventor.

Factor (A) Breadth of the claims:

No guidance is given in the specification for relating the volume change of the sensor to the concentration of fuel, which the sensor is in contact with. It is unclear how

the volume change of the sensor substrate conveys the concentration of the fuel. The relationship between an electronic signal output and the change in volume of the sensor resulting from measuring the fuel concentration is not disclosed

Factor (B) The nature of the invention:

By what means can a volume change of the sensor film located on the substrate layer of the sensor correlate to the concentration of the fuel within an electrochemical device? The applicant has not provided enough information so that one having ordinary skill in the art might make and use the invention of a sensor that changes in volume to indicate the concentration of the fuel with which it is in contact. In paragraph 29 on page 8 of the specification the applicant states with respect to Figure 3, a sensor comprising a pressure film on a substrate varies in volume depending on the concentration of the fuel. There is no disclosure of how to use the sensor for determining the concentration or change in concentration of a given fuel solution.

Factor (C) The state of the prior art:

In the prior art it is known that passing an electrical current through a conductor and measuring the change in electrical resistance of the conductor is an accurate method of measuring a change in concentration of the conductor. Therefore, as the fuel concentration changes, the electrical resistance of the conductor in contact with the fuel changes. In an electrochemical device, a current sensor is used to measure the current in a short circuit across the sensor electrodes. The measured current across the sensor electrodes is then correlated to the concentration of the substance with which the

sensor has contact. The current application is not aligned with the known method of determining the concentration of a substance.

Factor (D) The amount of direction provided by the inventor:

The applicant's claim of a measuring a fuel concentration with a sensor that undergoes a volume change provides no insight as to how to make and use the claimed invention. The change in volume of a material or solution is not an indication of its concentration as shown in the prior art. The applicant does not provide the proper mechanism by which a volume change in a material relates to the concentration of the material.

Having considered the evidence as a whole, the claims are properly rejected for scope of enablement as set for in MPEP section 2164.04 and 2164.05.

Response to Arguments

5. Applicant's arguments filed August 27, 2007 have been fully considered but they are not persuasive.

Applicant argues that Examiner's response to the argument in the previously filed Advisory Action is not correct, because the argument includes the fact that the pressure correlation with volume and concentration is not taught. Applicant argues this, because pressure is not recited and thus cannot be used as the basis for the rejection.

Examiner respectfully disagrees and upholds the previous position. Although pressure is not in the claims, it is in the specification and seems to be an integral factor in figuring out the volume change and concentration value. Therefore, since this

relationship is missing, one of ordinary skill would not be about to ascertain make and use the invention.

Applicant also argues that sufficient enablement exists because: (a) para 0023-0025 and 0028 describe the location and function of the sensor, (b) para 0029-0030, 0036-0037, and figs. 3-4 show the structure and operation, (c) the material of the pressure film is disclosed in para 0030 and 0036, and (d) that para 0032 and 0039 along with figs. 5-6 show the substantially linear relationship between the volume change of the sensor and the concentration of fuel within a certain concentration range

Examiner upholds the position that while the indicated portions in the argument broadly presents the relationship, it lacks reasonable description as to how pressure is correlated to concentration. Again, as stated above, although pressure is not stated in the claims, pressure is an integral factor in order to obtain the volume and concentration. Without a clear teaching of the relationship, one of ordinary skill in the art would not reasonably be able to make the and use the invention.

Claim Interpretation

6. Claim 1 now recites that that "the diluent is H_2O." This language is given the interpretation that the diluent comprises H_2O. This is because there is no support within the Specification that the diluent provided consists of water. As stated in paragraph 0022: "The byproduct of the oxidation and reduction reactions, for example, water, flows into the diluent storage unit 107 and is used as fuel diluent."

It is noted that the reaction for a direct methanol fuel cell are as follows:

$$\text{Anode: } CH_3OH + H_2O \rightarrow CO_2 + 6H^+ + 6e^-$$

$$\text{Cathode: } (3/2)O_2 + 6H^+ + 6e^- \rightarrow 3H_2O$$

$$\text{Net reaction: } CH_3OH + (3/2)O_2 \rightarrow CO_2 + 2H_2O$$

So, therefore, at least CO_2 would be a byproduct stored in the diluent tank as well and could be considered as diluent. Furthermore, the reactions listed above are *theoretical* reactions, considering 100% consumption of methanol. No support exists to show that 100% consumption positively exists. In this manner, one of ordinary skill would reasonably expect some unconsumed fuel and oxidant to be released in the exhaust. Furthermore, no separator is shown between the exhaust and the diluent storage tank for separating unreacted reactants and the water (looking at fig. 1). Therefore, the broadest reasonable interpretation of the new limitation is comprising language, barring proof to the contrary.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by US 6,303,244 B1 (Surampudi et al.).

As to claim 1, Surampudi et al. discloses a direct methanol feed fuel cell system. The system is composed of a fuel cell stack [924], a methanol fuel storage tank [900], a circulating tank [906], condensers [940, 942] (which acts as a dilutent storage unit that stores only a diluent that is a byproduct of the chemical reaction in the fuel cell stack), and a methanol concentration sensor that provides input to a controller to regulate the fuel cell system (col. 18 lines 5-19; See Figure 9). The fuel cell stack is comprised of an anode and cathode and generates electrical energy (col. 3 lines 25-32).

As to claim 3, Surampudi et al. teach of a fuel mixing unit (circulation tank [906]). Circulation tank [906] is a fuel mixing unit, as it allows the diluent from condenser [940] to flow into it as well as methanol from the fuel storage unit (methanol tank [900]).

As to claim 4, Surampudi et al. teaches that the methanol sensor should be located in the methanol fuel or very close to the methanol fuel (col. 18 lines 14-15).

As to claim 6, Surampudi et al. teach a line between the fuel storage unit (methanol tank [900]) and the diluent storage unit (condensers [940, 942]). This line is [918], and it supplies the fuel mixture to the fuel cell stack (fig. 9).

As to claim 7, Surampudi et al. show sensor [916] is located in line [918] (fig. 9).

8. Claim 17 is rejected under 35 U.S.C. 102(e) as being anticipated by Beckmann et al. (US 6890674).

As to claim 17, Beckmann et al. teach the use of Nafion, which expands (changes volume) relative to methanol concentration is used as a switch, valve, or sensor in a fuel cell (col. 8, lines 7-25). It is shown in fig. 7A and 7B that the sensor film is on a substrate. Fig. 8 depicts the sensor embodiment having a conductor [70]

fastened to Nafion material [72]. The sensor embodiment of Nafion communicates a concentration level of methanol (thus outputting a signal) (col. 8, lines 37-38). The Nafion conductor displays such a signal via known resistance values, wherein relaxed and strained Nafion have different resistance values. The methanol concentration affects this and thus sends the resistance values in comparison to known values. In this manner, a signal is output with respect to an expansion coefficient. These signals sent correspond to values that can be interpreted as both within and not within a defined reference range (barring clear definition of what constitutes a reference range). Additionally, the sensor as taught by Beckmann et al. would be capable of sending out a signal when an expansion coefficient of the sensor is not within a reference range, as it outputs signals with respect to the expansion of Nafion.

It has been held that the recitation of an element is "capable" of performing a function is not a positive limitation but only requires the ability to so perform. It does not constitute a limitation in any patentable sense. *In re Hutchinson,* 69 USPQ 138.

While intended use recitations and other types of functional language cannot be entirely disregarded. However, in apparatus, article, and composition claims, intended use must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In a claim drawn to a process of making, the intended use must result in a manipulative difference as compared to the prior art. In re Casey, 370 F.2d 576, 152 USPQ 235 (CCPA 1967); In re Otto, 312 F.2d 937, 938, 136 USPQ 458, 459 (CCPA 1963).

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). See also MPEP § 2114.

The manner of operating the device does not differentiate an apparatus claim from the prior art. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

9. Claim 18 is rejected under 35 U.S.C. 102(e) as being anticipated by Beckmann et al. as evidenced by US 2003/0091887 (Ihonen et al.) and DuPont – Nafion Membranes and Dispersions.

As to claim 18, Nafion (the material taught by Beckmann et al.) is proton conducting polymer (as evidenced by Ihonen et al. (para 0003) and Nafion Membranes and Dispersions).

Response to Arguments

10. Applicant's arguments filed August 27, 2007 have been fully considered but they are not persuasive.

Applicant argues that the Surampudi et al. does not store "only a diluent that is a byproduct of the chemical reaction in a stack ... wherein the diluent is H_2O."

Examiner respectfully disagrees. Only a diluent of the byproducts exists, as the condensers [940] and [942] are fed from the exhaust of the fuel cell stack. Although

unconsumed methanol is stored in the condensers, so is water. Thus the diluent comprises H_2O (applying the claim interpretation, explained above). Furthermore, it is noted that unreacted methanol by itself would not be considered a diluent, as it is the water that dilutes the methanol, so therefore the byproduct water is acting to dilute methanol to form the diluent solution of H_2O/CH_3OH of Surampudi.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

11. Claims 2, 5, 8, 9, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi et al. as applied to claims 1, 3, 4, 6, 7, in view of US 6,890,674 B2 (Beckmann et al.).

As to claims 2, 5, and 8, Surampudi et al. does not disclose that the sensor has a portion that varies in volume depending on the concentration of the fuel (as required by claim 2) and detects the fuel concentration using the fact that volume of the sensor changes depending of fuel concentration (as required by claim 5 and 8).

Beckmann et al. teaches a method and apparatus for managing fluids in a fuel cell system. Beckmann teaches the use of various devices to control fuel concentration in a direct oxidation fuel cell system such as a direct methanol fuel cell (col. 1 lines 39-42; col. 2 line 63 to col. 3 line 4). One device for determining the concentration of the fuel is a sensor (col. 3 lines 50-62). The sensor is constructed of Nafion™. The Nafion™ expands or varies in volume when exposed to a methanol solution (col. 8 lines 8-16). The amount of expansion experienced by the Nafion™ is directly related to the concentration of methanol fuel. The amount Nafion™ expands is predictable and essentially linear over the relevant methanol concentrations (col. 8 lines 21-25). The motivation to use the concentration sensor is to accurately measure and control the methanol concentration provided to the fuel cell. Furthermore, one of ordinary skill in the art would have been able to appreciate the use of the concentration sensor as taught by Beckmann et al. in the system of Surampudi et al. with reasonable

expectation of success. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the system of Surampudi et al. to include Nafion™ (a material that varies in volume depending on the concentration of the methanol solution to which it is exposed) as taught by Beckmann et al. in order to accurately measure and control the methanol concentration provided to the fuel cell, as one of ordinary skill in the art would have appreciated the changing of methanol sensors with reasonable expectation of success.

As to claim 9, Surampudi et al. does not teach that the sensor comprises a substrate, a sensor film attached to a surface of the substrate, wherein the sensor film changes volume depending on the concentration of the fuel in the fuel mixture solution.

Beckmann et al. teach the use of Nafion, which expands (changes volume) relative to methanol concentration is used as a switch, valve, or sensor in a fuel cell (col. 8, lines 7-25). It is shown in fig. 7A and 7B that the sensor film is on a substrate. The motivation to use the concentration sensor is to accurately measure and control the methanol concentration provided to the fuel cell. Furthermore, one of ordinary skill in the art would have been able to appreciate the use of the concentration sensor as taught by Beckmann et al. in the system of Surampudi et al. with reasonable expectation of success. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the system of Surampudi et al. to include Nafion™ (a material that varies in volume depending on the concentration of the methanol solution to which it is exposed) as taught by Beckmann et al. in order to accurately measure and control the methanol concentration provided to

the fuel cell, as one of ordinary skill in the art would have appreciated the changing of methanol sensors with reasonable expectation of success.

As to claim 13, Beckmann et al. teaches a sensor using Nafion embodied in fig. 8. In this embodiment, the sensor is an electronic circuit that outputs signals depending on the change in the volume sensor. This is done as Nafion communicates a concentration level of methanol (col. 8, lines 37-38). The Nafion conductor displays such a signal via known resistance values, wherein relaxed and strained Nafion have different resistance values. These signals sent are in some way electronic, as the sensor is an electronic circuit (fig. 8; col. 8, lines 37-67).

12. Claims 11 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Surampudi et al., as applied to claims 1 and 9, as evidenced by Ihonen et al. and DuPont – Nafion Membranes and Dispersions.

As to claims 11 and 15, Nafion (the material taught by Beckmann et al.) is proton conducting polymer that is a perfluorinated sulfonic acid polymer (as evidenced by Ihonen et al. (para 0003) and Nafion Membranes and Dispersions).

13. Claim 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Beckmann et al., as applied to claim 17, in view of Surampudi et al.

With respect to claim 19, Beckmann et al. teaches the use of Nafion as the sensor but does not teach the use of polystyrene sulfonic acid, poly ether ether sulfone sulfonic aced, sulfonated polyolefin, or sulfonated polysulfone as the polymeric ion exchange membrane in the sensor.

Surampudi et al. demonstrates that Nafion and polyethylene and polypropylene sulfonic acids (sulfonated polyolefins) and polystyrene sulfonic acids are function equivalents within the use of a fuel cell (col. 6, lines 55-57). Therefore, one of ordinary skill in the art at the time the invention was made would have found it obvious to substitute the Nafion of the sensor of Beckmann et al. with sulfonated polyolefins or polystyrene sulfonic acids, as taught by Surampudi et al., with predictable result of obtaining a sensor that functioned in the same manner. It has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin,* 125 USPQ 416.

Response to Arguments

14. Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

Allowable Subject Matter

15. Claims 10, 12, 14, and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an Examiner's statement of reasons for allowance: none of the prior art of record, alone or in combination, appear to teach, suggest, or render obvious the invention of at least claim 10.

Claim 10 teaches a fuel cell control system with a sensor, wherein the sensor comprises an external electrode, an internal electrode, and a sensor member that fills

the space between the internal electrode and the external electrode, wherein the sensor member changes volume thereof depending on the concentration of the fuel mixture solution.

Beckmann et al. teaches a sensor that changes volume depending on the concentration of a fuel mixture solution (exemplified configurations are shown in figs. 7A, 7B, and 8) (col. 8, lines 37-60). Furthermore, Beckmann et al. teach how resistance value is used to calculate the fuel concentration (col. 8, lines 37-67). However, Beckmann et al. fail to teach the configuration with an external electrode, an internal electrode, wherein the sensor material is disposed in the space between the external and internal electrode. US 2002/0105345 (Yatsuda et al.), made of record but not relied upon, shows a sensor that measures resistivity (wherein resistance and resistivity are related by the equation resistance = (length*resistivity)/area). As seen in fig. 1, it has an internal electrode (central electrode [1]) and an external electrode (outer electrode [2]). However no sensor material is disposed between the two electrodes. Furthermore, the sensor taught by Yatsuda et al. is meant to be used with liquids (see example 1, para 0020-0022 for an example). Therefore there is no motivation for the combination of putting a solid expandable sensor member between the two electrodes in order to use the resistance values to obtain concentration values.

Since claims 12, 14, and 16 are dependent on claim 10, they would be allowable for the same reason.

16. Claim 20 is allowed.

The following is an Examiner's statement of reasons for allowance: none of the prior art of record, alone or in combination, appear to teach, suggest, or render obvious the invention of at least claim 20.

Claim 20 teaches a fuel concentration sensor in a fuel cell comprising an external electrode, an internal electrode, and a sensor member that fills the space between the internal electrode and the external electrode, wherein the sensor member changes volume thereof depending on the concentration of the fuel mixture solution, and wherein a signal is output when an expansion coefficient of the sensor is not within a reference range.

Beckmann et al. teaches a sensor that changes volume depending on the concentration of a fuel mixture solution (exemplified configurations are shown in figs. 7A, 7B, and 8) (col. 8, lines 37-60). Furthermore, Beckmann et al. teach how resistance value is used to calculate the fuel concentration (col. 8, lines 37-67). However, Beckmann et al. fail to teach the configuration with an external electrode, an internal electrode, wherein the sensor material is disposed in the space between the external and internal electrode. US 2002/0105345 (Yatsuda et al.), made of record but not relied upon, shows a sensor that measures resistivity (wherein resistance and resistivity are related by the equation resistance = (length*resistivity)/area). As seen in fig. 1, it has an internal electrode (central electrode [1]) and an external electrode (outer electrode [2]). However no sensor material is disposed between the two electrodes. Furthermore, the sensor taught by Yatsuda et al. is meant to be used with liquids (see example 1, para 0020-0022 for an example). Therefore there is no motivation for the combination of

putting a solid expandable sensor member between the two electrodes in order to use the resistance values to obtain concentration values.

Conclusion

17. US 2002/0105345, made of record but not relied upon, is considered to be pertinent to the disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugenia Wang whose telephone number is 571-272-4942. The examiner can normally be reached on 7 - 4:30 Mon. - Thurs., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

EW

GREGG CANTELMO
PRIMARY EXAMINER

10/10/07